

# I INTRODUCTION

## VALUE ENGINEERING

Value Engineering (VE) is defined by the Society of American Value Engineers as "the systematic application of recognized techniques by a multi-disciplined team that identifies the function of a product or service; establishes a worth for that function, generates alternatives through the use of creative thinking; and provides the necessary functions, reliably, at the lowest overall cost." The key elements in this definition are the systematic approach using a multi-disciplined team, the identification of the basic function of the product or service, and the use of creative thinking to generate alternatives.

A VE study follows a standard study plan including the following phases:

Selection: selection of specific projects or processes to be studied, and selection of VE study team;

Investigation: acquisition of knowledge of design to be studied to determine its major functions and assess cost and relative worth;

Speculation: generation of alternatives for those functions identified in the investigation phase of the study;

Evaluation: use of the VE methodologies to eliminate some of the alternatives generated during the speculation phase and narrow number of alternatives;

Development: thorough analysis of the remaining alternatives, incorporating supporting cost data, sketches, and life-cycle cost analysis to ensure feasibility for implementation;

Presentation: written and possibly oral presentation of recommended alternatives to decision-makers for acceptance;

Implementation: incorporation of accepted value opportunities into project plans or process;

Audit: certification that desired results have been attained, properly documented, and reported.

## **VE AT THE VIRGINIA DEPARTMENT OF TRANSPORTATION**

The Virginia Department of Transportation (VDOT) has had an active VE program since the mid-1970's. At that time, the program consisted of one or two 40-hour training workshops per year. In 1986, the VE program became a permanent program within the Management Services Division, and a full-time coordinator was assigned. The VE coordinator managed the program, solicited projects to be studied from the central office preliminary engineering divisions and from the district offices, and facilitated all studies. The majority of studies since 1986 have been performed on highway construction plans. Between 1986 and June, 1990, over 60 studies were held, with accepted value opportunities averaging savings of approximately 10% of the overall project cost.

In December, 1989, the Commissioner approved plans to expand the VE program. The expansion included the establishment of regional VE coordinators, an increase in the number of studies and training sessions planned each year, and clearly defined procedures for selecting projects and tracking VE recommendations. In June, 2004, the program was transferred to the Scheduling & Contract Division.

The program now consists of a State Value Engineering Manager, and two Regional Value Engineering Managers.

### **LEGAL REQUIREMENTS**

During the 1990 session, the Virginia General Assembly passed House Bill 423, which added Section 33.1-190.1 to the Code of Virginia. This section requires that value engineering be employed on any VDOT highway construction and maintenance projects costing more than \$2 million. The new law was effective on July 1, 1990. (A copy of HB 423 is contained in Appendix 1.) This legislation was amended by the 2001 session of the Virginia General Assembly raising the threshold to \$5 million, effective July 1, 2001.

The Intermodal Surface Transportation Efficiency Act, passed by the Federal Government in 1999, included a requirement for Value Engineering Studies on all Federal Aid projects with an estimated total cost of \$25 million or more.

## II. VE PROGRAM MISSION

The mission of the VE program is:

To assist VDOT management in obtaining optimum value from transportation funds through the VE process by:

- Improving project quality
- Eliminating unnecessary costs
- Reducing overall life-cycle costs.

This is accomplished by using the VE methodology to identify and define the basic functions of highway projects and their components, and recommend ways to meet the identified functions at the lowest possible cost.

Activities conducted by the VE program staff to meet the mission include conducting value engineering studies, facilitating and tracking implementation of VE recommendations generated through the VE process, and training VDOT staff in the value engineering methodology.

### III. VE PROGRAM ORGANIZATIONAL STRUCTURE

#### VE REGIONS

The VDOT VE program includes four geographical regions, each with a regional VE manager. The regions were defined through an analysis of planned construction projects, geographic location, and expected project complexity. The Central Office is included as part of a region. Each of the regional managers is responsible for the districts in the assigned region, as shown below:

<u>REGIONS</u>	<u>DISTRICTS</u>
1	Bristol, Salem, Lynchburg
2	Richmond
3	Central Office, Hampton Roads, & Staunton
4	Northern Virginia, Culpeper, & Fredericksburg

Since November, 1999, Regions 3 and 4 have been temporarily combined.

The VE manager in each region is responsible for coordinating the selection of the VE team, conducting VE studies on the selected projects, reporting and tracking VE recommendations, and coordinating VE training within the assigned region. The Central Office Manager also monitors and reports on the status of VE recommendations as they are implemented statewide.

#### STAFFING

The State Value Engineering Manager is classified as an Engineer II and the Regional VE managers are classified as Engineer I. They are salaried employees of the Scheduling & Contract Division (S&C). Expenses and salaries are charged to S&C.

#### REPORTING RELATIONSHIPS

The Regional VE managers report directly to the State Value Engineering Manager. However, because the regional managers are physically located in selected district offices, they are dependent on the district for team members, equipment, office space and meeting rooms. The District Administrator assists in the selection of the regional manager for each respective district, and is consulted regarding the performance of the manager located in the region.

## IV. VE ADVISORY COMMITTEE

The VE Advisory Committee (VEAC) consists of the following persons, or their designees:

- Chief Engineer for Program Development
- Hampton Roads District Administrator
- Bristol District Administrator
- Salem District Administrator
- Richmond District Administrator
- Northern Virginia District Administrator
- Location and Design Division Administrator
- Structure and Bridge Division Administrator
- Traffic Engineering Division Administrator
- Environmental Division Administrator
- Right of Way Division Administrator
- Asset Management Division Administrator
- Federal Highway Administration representative
- Scheduling and Contract Division Administrator (chair); and
- State VE Manager (Staff)

The role of the committee is to provide overall guidance and direction for the VE program. The committee meets at least annually and additional meetings may be called by any member. Interim business may be conducted by telephone, mail, or E-mail.

## V. VE STUDIES

VE studies of highway design projects can occur at one or more stages of project development. First, they can be conducted at the Scoping (conceptual) stage prior to commencement of design activity.

Second, they can occur at the “Preliminary Field Inspection” (PFI) stage, or when approximately 20% of the design is complete. At this point, the project design is at a stage where the team can make recommendations on the alignment and overall design of the project without concern that changes will affect the project schedule.

A third appropriate time for the VE study is at the “Field Inspection” stage, when approximately 70% of the design has been completed. At this stage, the VE team has access to more complete project information, including most of the specific items to be included in the completed roadway. Cost estimates are more likely to be complete at this stage.

### IDENTIFICATION OF POTENTIAL PROJECTS

In the spring of each year, potential construction and maintenance projects are identified by the regional VE managers and consolidated by the State VE manager.

### CONSTRUCTION PROJECTS

Project selection for construction projects is based on information from:

- the latest revision of the Six-Year Improvement Program,
- the Program/Project Monitoring System (PPMS),
- the Project Cost Estimating System (PCES),
- preliminary field reviews, and
- interviews with the Location and Design, Structure and Bridge, Urban, Local Assistance and Asset Management managers in the respective districts or Central Office.

All projects with expected costs of over \$5 million at the time of field inspection are included in the list of projects for potential study. All bridges with an estimated construction cost of \$5 million or more will be studied. Other projects will be selected to complete the annual workplan based on the following criteria:

- high estimated project construction or operation cost;
- project schedule, including projects which have:
  - ◇ proposed long construction times,
  - ◇ short design schedules,
  - ◇ complicated and lengthy design processes, or
  - ◇ significant time between completion of design and actual construction;

- project complexity; and
- recommendations from district and central office preliminary engineering managers.

## **DESIGN/BUILD AND PUBLIC/PRIVATE TRANSPORTATION ACT (PPTA) PROJECTS**

Value Engineering is required on all VDOT Design/Build and PPTA projects in accordance with Section 33.1-190.1, Code of Virginia, 1950, with an estimated cost of \$5 million or greater, unless a waiver is granted by the Commissioner. This has been confirmed by the Chief Engineer and the Assistant Attorney General for Transportation. This requirement is further supported by federal legislation requiring Value Engineering on all projects meeting the \$25 million threshold (23 CFR 627.1(a)).

The schedule for conducting Value Engineering studies will be prior to release of the "Request for Proposals" document; for projects where contracts for design have been awarded, the following policies will be implemented:

Innovative Program Delivery will coordinate the tracking of Design/Build and PPTA projects that meet the criteria requiring a Value Engineering study and notify the State Value Engineering Manager to schedule these studies.

## **SOUNDWALLS**

Sound wall studies are to concentrate on the construction components (i.e., landscaping, drainage, fencing, etc.) rather than the specific sound wall design. The Commissioner has approved a policy mandating a VE study of Sound Barrier standards every two years in addition to the above detailed individual project studies.

## **MAINTENANCE PROJECTS**

In accordance with the Code of Virginia, Section 33.1-190.1, highway maintenance projects costing \$5 million or greater that serve to upgrade an existing system or produce a new system accompanied by, at least, a minimum set of plans will be subject to a Value Engineering study. Projects funded by a combination of maintenance and construction funds totaling a cost of \$5 million or greater will be subject to a Value Engineering study.

**EXEMPTION CLAUSE:** Projects/contracts repetitive in nature, such as plant mix overlays, sign overlays, bridge painting, surface treatments, slurry seals, guardrail maintenance, pavement repairs, pavement markings, and epoxy or latex overlays do not lend themselves to VE study as the costs of such contracts are multiples of the same project. Projects of this repetitive nature will only be Value Engineered as components of the VDOT Standards studies and VDOT Policies and Procedures studies.

Projects/contracts that are considered "Emergency", where immediate action must take place to ensure the safety of the traveling public, will be eliminated from consideration for VE study.

For maintenance project selection the State VE Manager will be copied on the six-month maintenance schedule along with the final budgets. For projects/contracts where alternative cost analysis meetings are held, a VE Manager will be invited to participate.

## **ANNUAL VE WORKPLAN**

After the projects for potential VE study are identified, an Annual VE Workplan is prepared. The workplan lists all projects expected to be studied during the fiscal year, estimated costs of the projects, planned locations of the studies, and the months in which the studies are expected to occur. The Workplan will then be made available to the VE Advisory Committee. The committee may recommend additions or substitutions to the workplan.

Throughout the year, additions and deletions may be made to the workplan due to changes in project schedules and cost.

## **ASSIGNMENT OF PROJECTS**

The State Value Engineering Manager assigns projects for study to specific VE managers based on the location of the project and the workload of the regional managers. It is the responsibility of the assigned manager to establish and maintain communications with the project manager to ensure that the VE study occurs at the appropriate stage of project development (i.e., PFI or FI).

The Urban representative in the respective district is notified in, writing, at least one month in advance, or as soon as possible, whenever an urban project is scheduled for a VE study.

## **CONDUCT OF VE STUDIES**

Under the Concurrent Engineering Process (CEP) implemented at VDOT in 2002, VE studies will normally be conducted at the PFI stage of project development.

## **TEAM SELECTION**

VE study teams are typically composed of four to eight members trained in the VE process and familiar with highway design. Team members are selected based on expertise in the specific discipline(s) needed for the project. Once the VE study is scheduled, the regional VE manager determines the specific disciplines required on the study team.

EXAMPLE: For a study of a bridge and approach design project that crosses wetlands, team members from the following divisions or sections may be included:

- Environmental, for expertise in permits and wetlands;
- Location and Design, for expertise in roadway design;
- Structure and Bridge, for expertise in bridge design;



- Traffic Engineering, for expertise in traffic control; and
- Materials, for expertise in soil conditions and pavement design
- NOTE: On all projects that have Federal oversight, an FHWA Representative will be invited to serve as a VE team member.

As soon as possible after receipt of the PFI or FI notification (as appropriate), the assigned VE manager contacts the appropriate district section managers to request VE team members. In addition, the VE manager will copy the district administrator and the State Value Engineering Manager.

Regional VE managers may request team members from other regions as well as the central office. Representatives from cities may be requested through the district Urban representative. Additionally, an FHWA Representative will be invited to attend all projects with Federal oversight.

The assigned VE manager notifies selected team members by letter, E-mail, telephone, or in person, indicating the project to be studied, the location of the study, and the daily schedule.

When establishing beginning times for the study sessions, consideration is given to team members' travel time.

## **CONDUCTING STUDIES**

As soon as the dates for the VE study are scheduled, the regional VE manager reserves a meeting room. The manager also obtains all information available on the project for the VE study. Suggested information includes but is not limited to:

- project plans;
- project correspondence;
- project file;
- photographs/video;
- adjacent project/roadway design;
- detailed cost estimate;
- environmental documents and other studies; and
- list of individuals involved with the project and their telephone numbers.

During the study, questions about the history of the project will be directed to the project manager by telephone or in person.

The assigned VE manager functions as team leader, is responsible for leading team interaction, and ensures that the VE process is followed. The manager provides the team members with forms necessary to document the VE process and completely develop the recommendations.

One step in the VE study process is the identification of those persons who will make the final decisions on the VE recommendations, or the identified decision-makers. These persons will receive the final report after the study.

VE studies usually require three to four days for an average project. However, the actual length of time required is determined by the complexity of the project and the team composition. A condensed study format, which requires one to two days, may be used for low cost/complexity projects and topic specific studies.

## **PERFORMANCE MEASURES**

VE Team recommendations, which are forwarded to the applicable decision-makers, may include Quantitative Performance Measures (cost savings/increases) and Qualitative Performance Measures which identify applicable benefits of the recommendation. The Qualitative measures include: (1) Minimize Environmental Impact; (2) Improve Constructability; and (3) Enhance Operational Performance. These categories are further defined below:

### **Minimize Environmental Impact**

- Parks/Recreation
- Historic/Cultural
- Aesthetics
- Wetlands/Streams
- Permitting
- EIS/CE
- Noise
- Wildlife

### **Improve Constructability**

- Maintenance of Traffic
- Construction Time
- Construction Materials
- Sequence of Construction
- Feasibility

### **Enhance Operational Performance**

- Safety
- Maintainability
- Level of Service
- User Costs
- Future Expansion
- Driver Expectancy

## **PRESENTATION OF VE RECOMMENDATIONS**

At the conclusion of the study, the regional VE manager develops an Executive Summary of the study and the resulting VE recommendations, which, with the completed Study Documentation, serves as the official report. The regional VE manager submits the completed Study Report, which includes the Executive Summary, Study Documentation, a VE response form, and all appropriate cover letters, to other members of the VE staff for editorial review. When the package is approved by the reviewers, it is sent by the regional VE manager to the previously identified decision makers responsible for acceptance of the VE recommendations. A copy of the cover letter, Executive Summary and response form is also sent to the State Value Engineering Manager.

The list of identified decision-makers may include the District Location and Design Engineer, the District Construction Engineer, and the State Location and Design Engineer. Whenever a VE recommendation directly relates to right of way is submitted, the Right of Way Division Administrator is included. Similarly, the Materials Division Administrator should be included whenever a VE recommendation addresses pavement. Responsible persons may also include the Structure & Bridge Engineer, Local Assistance Engineer, the Resident Engineer, representative of a locality or if applicable, an FHWA Division Administrator may elect to serve as a decision-maker on Federal oversight projects. These persons are requested to respond to the VE recommendations, in writing, with a copy to the State Location and Design Engineer. The responses are sent to the VE manager assigned to that project.

## **ACCEPTANCE OF VE RECOMMENDATIONS**

Responses received from the identified decision-makers indicate which VE recommendations are acceptable for implementation, and provide reasons for rejecting those that are not acceptable. The responses are sent by the assigned VE manager to the central office VE manager, who compiles the responses and sends them to the Chief Engineer for his approval.

## **IMPLEMENTATION OF VE RECOMMENDATIONS**

Notification of the Chief Engineer's approval is sent to all the decision-makers, project manager and VE team members. If the project has Federal Oversight, the approval form will also be sent to FHWA, even if they did not participate as a VE team member in the study.

The project manager verifies the incorporation of each accepted VE recommendation in writing or by E-mail to the central office VE Manager.

Any VE recommendation which is approved by the Chief Engineer pending further investigation is monitored until the study is complete and final resolution is determined.

## **APPEAL OF ACCEPTED VE RECOMMENDATIONS**

If the project manager should find that an accepted VE recommendation cannot be implemented, a letter or E-mail explaining the situation and requesting repeal of the VE recommendation is sent to the appropriate regional value engineering manager. The VE manager adds his or her comments, and forwards it to the State Value Engineering Manager. It is then sent to the Chief Engineer for his action.

## VI. VE TRAINING

VE training is offered to the employees of VDOT in two ways: a week-long session for potential team members, and a one day session for managers. The VE Training Manager, assigned by the State VE Manager, develops an annual training plan with advice from the regional VE managers. The plan identifies when each of the courses will be presented in each region.

The regional VE managers plan and facilitate training in their respective regions, with assistance from the VE Training Manager. Regional VE managers maintain records of VDOT staff trained in their region, and the VE Training Manager maintains records of all staff trained statewide.

Specific procedures for administration of the VE Training Program are contained in the Value Engineering Managers' Guidelines.